THE INFLUENCE OF THE SHALLOW WATER INTERNAL WAVE FIELD ON THE PROPERTIES OF ACOUSTIC SIGNALS

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LONG TERM GOALS

Quantitatively relate the temporal and spatial properties of shallow water acoustic signals to the physical processes which cause the temporal and spatial variability of the propagation channel. Address internal waves, tides, surface gravity wavefields and the heterogeneous ocean bottom/subbottom.

SCIENTIFIC OBJECTIVES

Increase the understanding of the physics of broadband acoustic signal propagation through the random shallow water waveguide.

APPROACH

This research is focused on the analysis of portions of a data set obtained during an interdisciplinary oceanographic and ocean acoustics experiment (SWARM95). The experiment's objective was to increase the basic understanding of the physics of acoustic signal propagation through slope/shelf internal wave fields. The experiment required extensive physical oceanographic measurement to quantify the generation, propagation and decay of those internal wave fields. The experiment was conducted on the New Jersey Shelf during the summer of 1995. The acoustic propagation path was placed on the NSF Ocean Drilling Program Seismic Line 1003. An extensive ONR/NSF geologic and geophysical data set has been developed for this line and is being used to include the effects of the heterogeneous bottom on the acoustic signals. Two acoustics sources (224 Hz and 400 Hz) were place at a distance of about 37 and 42 km from two vertical receiving arrays. Numerous thermistor arrays. temperature pods and bottom moored ADCPs were placed to monitor the properties of the water column.

WORK COMPLETED

The FY97's effort was focused on: 1) the digitization of 22 days of analog high frequency flow visualization data; 2) the refinement of computer techniques to track internal wave displacement of scattering horizons; 3) the initialization of the

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tracking of the scattering horizons; 4) providing sections of the tracked data to colleagues for propagation modeling purposes; and 5) contributing to an article (multi-author outlining the initial results of the SWARM95 experiment).

RESULTS

The primary focus of the experiment was to measure the statistical and deterministic properties of the shelf internal wave field and relate those properties to the coherence, range dependent scintillation index and time fluctuation properties of the acoustic signals.

Digitized acoustic flow visualization data have been used to perturb the range dependent sound speed field interpolated from tow-yo CTD data taken along the acoustic propagation track. Broadband acoustic signals numerically propagated through this sound speed profile were compared to data.

Simulated signal characteristics were comparable to data only if the internal wave influence was included in the sound speed field. The calculations were done using inhomogeneous and rough bottom/subbottom viscoelastic parameters extracted from Chirp subbottom profile data (work done by Altan Turgut, NRL) taken during the experiment.

IMPACT ON/APPLICATIONS

Results will permit the prediction of ASW system performance in shallow water propagation channels randomized by internal wave fields.

TRANSITIONS

Presentations to ONR, PEO-ASTO-USW

RELATED PROJECTS

This research effort is a collaborative effort between Dr. James Lynch and associates from the Woods Hole Oceanographic Institution; Dr. John Apel, Ocean Associates Inc.; Dr. Mohsen Badiey, The University of Delaware; Dr. C. S. Chiu, the NPGS; and scientists at the Naval Research Laboratory. Results reported represent the efforts of several members of this team of scientists. The research effort is supported by ONR.

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